Saskatchewan

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FINAL REPORT

HARVESTING METHOD AND ITS EFFECT ON RELATIVE FORAGE YIELDS

19970234

Final Report

to

Agricultural Development Fund (ADF)

From

Saskatchewan Forage Council

For

Project # 97000234

Harvesting Method and its Effect on Relative Forage Yields

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1.0 1 ACKNOWLEDGEMENTS:

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1.0 2 ABSRACT:

Mechanical harvesting of forage trials often underestimates the yield of forage species with basal growth habit. For example, (meadow bromegrass and Russian wildrye). Most of the data collected on perennial forage yield is collected using a mechanical harvester because it is the most efficient method of harvesting a large number of small plots, and the primary goal is to estimate hay yield. We are limited in how close we can cut to the ground, and still estimate expected hay yield (5-6 inch stubble height is left). The result is a lower estimate of yield potential for many of our forage species that were primarily developed for grazing (species usually with many basal leaves). For carrying capacities and stocking rates to be as accurate as possible there must be correction factors developed to allow for adjustment of yields for species which are not reflected accurately in mechanical harvesting. It has been determined that the biomass of individual grass plants is not exclusively determined by height alone. Several factors related to growth form determine weight and these factors are modified by the environment (Caird, 1945; Clark, 1945). Wide row spacing can produce taller plants that are easier to harvest by machine than narrow rows (McGinnies, 1970; Leyshon et al. 198 1). Morphological variation between species also affects the proportion of biomass produced at varying levels in the crop canopy (Lodge et al. 1972). This is evident in Russian wildrye, where a large proportion of biomass is produced close to the ground due to its prostrate growth habit. Leyshon et al (1981), investigated the yield differences in Russian wildrye with harvesting method. Two harvesting methods were used; a flail type forage harvester and hand clippers. Results indicated that in 15-cm rows, the machine harvested first cut left 74-93% of the dry matter yield harvested by hand. With 60 cm rows, the amount do dry matter remaining after the machine harvested first cut left 45-68% of the total harvested by hand. In summary, the machine left behind 33 -70% of the forage in narrow (15 cm) rows and 33-38% in the wide (60 cm) rows. The double sampling method consists of collecting two types of biomass data, one is clipped and the other is mechanical harvested.

The objectives of this project were to: provide baseline data on variety yields under conditions similar to animal harvesting methods; develop a relationship between clipped and machine harvested yields which will allow extension personal to better estimate initial stocking rates for many of our grazing species in Saskatchewan. Data was collected at Scott, Saskatchewan, using the established wheatgrass, wildrye grass and meadow bromegrass trials. A linear regression was then developed for each forage species tested by regressing total forage yield (clipped + machine harvested forage yield) on machine harvested forage yield. Total forage prediction equations were developed for Crested Wheatgrass (CWG), Smooth Brome (SB), Meadow Brome (MB), Intermediate Wheatgrass (IWG), Russian Wildrye(RWR), Altai Wildrye (AWR), Northern Wheatgrass (NWG), Western Wheatgrass (WWG), Streambank wheatgrass (SBWG) and Tall wheatgrass (TWG). These prediction equations can be used by forage extension agrologists to correct estimated yield data (mechanical harvested) for expected total forage yield. These equrations only predict the total forage to ground level. The forage agronomist must also subtract the % of forage carry-over that must be maintained to allow for plant regrowth and development. In addition, these regression equations are based on one year of data, at one

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location and should be used with caution. It is recommended that more data be collected, with the inclusion of at least three site years of data and a number of locations. The following table gives a summary of the regression equations developed and the estimated accuracy of the equation.

Species	Equation	Sig. Level (0.05)	Adjusted R-Squared
Smooth Brome Grass	Total Yield = 2658+0.937*Machine Harvested Yield	***	74%
Meadow Brome Grass	Total Yield =2701+1.08*Machine Harvested Yield	**	78%
Crested Wheatgrass	Total Yield = 2576+1.09*Machine Harvested Yield	***	89%
Intermediate Wheatgrass	Total Yield = 2285+1.01*Machine Harvested Yield	***	90%
Tall Wheatgrass	Total Yield = 353+1.93*Machine Harvested Yield	*	99%
Northern Wheatgrass	Total Yield = 3395+0.841*Machine Harvested Yield	ns	73%
Streambank Wheatgrass	Total Yield = 1058+1.67*Machine Harvested Yield	ns	4%
Western Wheatgrass	Total Yield = 4361+0.594*Machine Harvested Yield	ns	91%
Russian Wildrye	Total Yield = 2384+1.11*Machine Harvested Yield	***	93%
Altai Wildrye	Total Yield = 2928+0.912*Machine Harvested Yield	*	58%

Table #1. Regression equations developed from the data collected on Clipping versus Machine Harvested plots at Scott, Saskatchewan. 1999.

Note: The above Prediction equations for the Predicted Forage Yield are based on one year and should be used with caution.

1.0 3 References:

Caird, R.W. 1945. Influence of site and grazing intensity on yield of grass forage in the Texas Panhandle.
Jour. Forestry. 43: 45-49.

Clarkj,   I. 1945. Variability in growth characteristics of forage plants on summer ranges in central Utah.
Jour. Forestry. 43: 274-283.

Leyshon, A.J., Cutforth, H., Waddington, J. and Rymes, P.C. 1990. Effects or row spacing on biomass production and above ground harvestability of Russian Wildrye.

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McGinnies, W.J. 1970. Effects of seeding rate and row spacing on establishment and yield of crested wheatgrass.
Agron. J. 62: 417-421.

1.0 4 PROJECT DESIGN:

A project to determine these correction factors will be carried out on one established site at Scott. The site contains 4'x 20'plots, replicated five times. The site includes meadow bromegrass, wheatgrass and wildrye grass trials with cultivars recommended for use in Saskatchewan. Each plot will have a one-quarter m2 areas hand clipped to grown level to simulate grazing. The biomass will be collected air dried at 60' C for 48 hours. The sample will then be weighted and the yield in Kg/ha (dry weight bases) will be calculated. The remainder of the plot will be harvested using a Swift Forage Plot harvester. A linear regression was developed to predict the total forage yield of the species tested. The independent variable for the prediction equation was the clipped yields versus the machine harvest yields. Harvesting was done once in early July (full head stage).

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2. 0 RESULTS:

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2.1   Bromegrass:

In 1999, Magna and Baylor smooth bromegrasss were the higher yielding varietes (table 1.). However, when the data is pooled over a five year period, Carlton yielded 12% and 17% greater than Magna and Baylor respectively. The differences between varieties within a species were not significanlty different. However, in 1999, Magna significantly out-yielded Paddock and Regar meadow brome, but not Fleet meadow bromegrass. When we compare the precentage of clipped yield to harvested yield, the yield of Paddock and Regar meadow bromegrass was underestimated more by machine harvesting than all of smooth brome varieties tested, in 1999 (table 2.). There was no significant difference in yield between smooth brome and meadow brome when the clipped yield was added to the machine harvested yield. In addition, when the prediction equations were used to calcuated total forage yield, the overall means were very similar and once again their was no significant difference in expected forage yield between species.   The prediction equation for smooth bromegrass was: Total Yield = 2658+0.937*Machine harvested yield. The regression equation was significant with an adjusted R-Squared of 74% (table 2.). The regression equation for meadow bromgrass was: Total yield = 2701+1.08*Machine harvested yield. The regression equation was highly significant with an adjusted R-Squared of 78%.

2.2 Wheatgrass:

In 1999, Summit crested wheatgrass out-yielded all other wheatgrass varieties tested except Parkway and Chief (table 3.). Chief, Summit, and Parkway yielded 121, 113 and 106% of Kirk when yields were averaged over five years.   A look at the amount of forage left after machine harvesting the plots,   indicates that Greenleaf intermediate wheatgrass was the most underestimated wheatgrass speices. Clipped yield was 153% of the machine harvested yield (table 4.). The next most underestimated wheatgrasses were Kirk at 133 and Clark at 118%. It is interesting to note that the two highest yielding wheatgrasses, hief and Summit, were also the least underestimated of all the wheatgrasses tested. However, 1999 at Scott, the combined yield (clipped + Mahine harvested) of Summit was significantly higher than all other wheatgrasses except Parkway and Chief (table 4).   The prediction equations for crested and intermediate wheatgrass were highly significant, with an adjusted R-squared of 89 and 90% respectively. In additon, the reqression equation for Tall wheatgrass was significant and had an adjusted R-squared of 99%.   However, the reqression equations for Northern, Streambank and Western wheatgrass were not significant (table 4.). When the reqression equations were developed, the data from varieties within a species was pooled to give a better prediciton of yield and to reduce the error term.   However, streambank, western wheatgrass, tall wheatgrass and northern wheatgrass were represented by only one variety and the data could not be pooled. As a result, we had limited data from which to develop the regression equations. It is suggesed that more data be collected on these forage species in order to develop better equations.

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2. 3 Wildrye grasss:

In 1999, Mayak wildrye outyielded all other wildryes except Swift (table 5.). Mayak yielded 114% of Swift when the data was averaged over five years. In 1999, the clipped yield of Pearl, Eejay and Prairieland was 122, 113 and 85 % of the machine harvested yield, respectively (table 6.). The reqression equation for Russian wildrye was highly significant with an adjusted R-squared of 93%. In addition, the reqression equation for Altai wildrye was significant and had an adjusted R-squared of 58%.

2.4 Combined Forage Yield:

Over all, when the forage yields obtained are averaged over the five years, Carlton smooth bromegrass outyielded all other forage varieties by greater than 7% (table 7.).

3. 0 CONLCUSION

The results indicate that at Scott, is was possible to develop regression equations for each species to accurately predict total forage yield to correct forage species that are machine harvested. The results of the this study are similar to those obtained by other researchers. However, these regression equations are based on only one site-year of data and must be used with caution.

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Table 2.1

1993 Brome Variety Adaptation Test

Scott, SK

Variety	1994 Total Forage Yield (kg DM/ha)	1995 Total Forage Yield (kg DM/ha)	1996 Total Forage Yield (kg DM/ha)	1997 Total Forage Yield (kg DM/ha)	1999 Total Forage Yield (kg DM/ha)	5 Year Average Total Forage Yield (kg DM/ha)	5 Year Average % of Carlton
Signal smooth	8313	2475	7344	5673	3397	5440	92
Magna smooth	8448	2453	6562	4178	4126	5158	87
Paddock meadw	7762	2710	7413	5004	2865	5149	87
Rebound smooth	6880	2640	7173	5560	3241	5099	86
Baylor smooth	7116	2204	7017	4393	3875	4921	83
Fleet meadw	7308	2705	6118	3946	3489	4713	80
Regar meadw	6403	2208	5604	3739	2942	4219	71
Mean	7638	2554	6933	4853	3410	5078	
C.V. (%)	11	18	14	21	13		
LSD (0.05)	996	ns	1224	1348	790		

Table 2.2

1993 Brome Variety Adaptation Test

Scott, SK

Variety	1999 Forage Yield (Hand-Clipping versus Machine Harvesting)						
	Clipped Forage Yield (kgDM/ha)	Machine Harvested Forage Yield (kgDM/ha)	Clipping+Machine Forage Yield (kgDM/ha)	Predicted Forage Yield (kgDM/ha)	Clipped as % of Harvested Forage Yield %	Clipped as % of Total Forage Yield %	Clipped as % of Predicted Forage Yield %
Paddock meadow	3159	2855	6013	5784	111	53	54
Regar meadow	2889	2942	5831	5878	102	50	50
Fleet meadow	2779	3489	6268	6469	83	45	43
Signal smooth	2394	3397	5791	5841	76	42	42
Rebound smooth	2372	3241	5612	5695	74	42	42
Baylor smooth	2794	3875	6669	6289	73	42	45
Magnasmooth	2404	4126		6603	67		
Mean	2624	3410	6034	6035	58	37	37
CV (%)	13	13	10	8			
LSD (0.05)	584	790	ns	ns			

Note: The Prediction equation for the Predicted Forage Yield

Smooth Brome Total Yield = 2658 + 0.937 * Machine Harvested Yield

Meadow Brome Total Forage Yield = 2701 + 1.08 * Machine Harvested Yield

Note: The above Prediction equations for the Predicted Forage Yield are based on only one year and should be used with caution.

Significance level (0.05)

** Machine Harvested Yield

*** Machine Harvested Yield

Adjusted R-Squared

74%

78%

Table 2. 1

1993 Brome Variety Adaptation Test

Scott, SK

Variety	1994 Total Forage Yield (kgDM/ha)	1995 Total Forage Yield (kgDM/ha)	1996 Total Forage Yield (kgDM/ha)	1997 Total Forage Yield (kgDM/ha)	1999 Total Forage Yield (kgDM/ha)	5 Year Average	
						Total Forage Yield (kgDM/ha)	% of Carlton
Carlton smooth	8876	3033	8013	6331	3356	5922	100
Signal smooth	8313	2475	7344	5673	3397	5440	92
Magna smooth	8448	2453	6582	4178	4126	5158	87
Paddock meadow	7762	2710	7413	5004	2855	5149	87
Rebound smooth	6880	2640	7173	5560	3241	5099	86
Baylor smooth	7116	2204	7017	4393	3875	4921	83
Fleet meadow	7308	2705	6118	3946	3489	4713	80
Regar meadow	6403	2208	5804	3739	2942	4219	71
Mean	7638	2554	6933	4853	3410	5078	
C.V. (%)	11	18	14	21	13		
LSD (0.05)	996	ns	1224	1348	790		

Table 2.2

1993 Brome Variety Adaptation Test

Scott, SK

1999 Forage Yield (Hand-Clipping versus Machine Harvesting)

Variety	Clipped Forage Yield (kg DM/ha)	Machine Harvested Forage Yield (kg DM/ha)	Clipping + Machine Forage Yield (kg DM/ha)	Predicted Forage Yield (kg DM/ha)	Clipped as % of Harvested Forage Yield %	Clipped as % of Total Forage Yield %	Clipped as % of Predicted Forage Yield %
Paddock meadow	3159	2855	6013	5784	111	53	54
Regar meadow	2889	2942	5831	5878	102	50	50
Fleet meadow	2779	3489	6268	6469	83	45	43
Signal smooth	2394	3397	5791	5841	76	42	42
Rebound smooth	2372	3241	5612	5695	74	42	42
Baylor smooth	2794	3875	6669	6289	73	42	45
Carlton smooth	2200	3356	5556	5803	67	40	38
Magna smooth	2404	4126	6531	6525	58	37	37
Mean	2624	3410	6034	6035			
CV. (%)	13	13	10	8			
LSD (0.05)	584	790	ns	ns			

Note The Prediction equation for the Predicted Forage Yield:

Significance level (0.05)

Smooth Brome Total Yield = 2658 + 0.937 * Machine Harvested Yield   **

Meadow Brome Total Forage Yield = 2701 + 1.08 * Machine Harvested Yield   ***

Note The above Prediction equations for the Predicted Forage Yield are based on only one year and should be used with caution.

Adjusted R-Squared
74%
78%

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Table 2. 3

1993 Wheatgrass Variety Adaptation Test
Scott, SK

Variety	1994 Total Forage Yield (kgDM/ha)	1995 Total Forage Yield (kgDM/ha)	1996 Total Forage Yield (kgDM/ha)	1997 Total Forage Yield (kgDM/ha)	1999 CUT#1 Forage Yield (kgDM/ha)	5 year average Total Forage Yield (kgDM/ha)	5 year average % of Kirk
Chief intermediate	9649	3298	5279	4640	4648	5503	121
Summit crested	6560	2605	6327	4878	5306	5135	113
Parkway crested	5054	2997	6479	5367	4196	4819	106
Kirk crested	6206	3220	6549	4469	2369	4563	100
Greenleaf intermediate	9013	2613	5226	3722	1881	4491	98
Clarke intermediate	9153	2606	4480	4011	2001	4450	98
Fairway crested	4946	2566	6067	4770	3442	4358	96
Nordan crested	5534	2581	6266	4264	3045	4338	95
Elbee northern	4865	1028	4034	2430	3249	3121	68
Orbit tall	5364	2089	3764	2102	1792	3022	66
Sodar streambank	4046	867	4123	2320	2290	2729	60
Walsh western	3628	690	3319	1690	3121	2490	55
Mean	6168	2263	5159	3722	3111	4085	
C.V. (%)	12	16	12	27	26		
LSD (0.05)	960	459	777	1300	1393		

Table 2.3

1993 Wheatgrass Variety Adaptation Test
Scott, SK

Variety	1994 Total Forage Yield (kgDM/ha)	1995 Total Forage Yield (kgDM/ha)	1996 Total Forage Yield (kgDM/ha)	1997 Total Forage Yield (kgDM/ha)	1999 CUT #1 Forage Yield (kgDM/ha)	5 year average Total Forage Yield (kgDM/ha)	5 year average % of Kirk
Chief intermediate	9649	3298	5279	4640	4648	5503	121
Summit crested	6660	2605	6327	4878	5306	5135	113
Parkway crested	5054	2997	6479	5367	4196	4819	106
Greenleaf intermediate	9013	2613	5226	3722	1881	4491	98
Clarke intermediate	9153	2606	4480	4011	2001	4450	98
Fairway crested	4946	2556	6067	4770	3442	4358	96
Nordan crested	5534	2581	6266	4264	3045	4338	95
Elbee northern	4865	1028	4034	2430	3249	3121	68
Orbit tall	5364	2099	3764	2102	1792	3022	66
Sodar streambank	4046	867	4123	2320	2290	2729	60
Walsh western	3628	690	3319	1690	3121	2490	55
Mean	6168	2263	5159	3722	3111	4085	
C.V. (%)	12	16	12	27	26		
LSD (0.05)	960	459	777	1300	1393		

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Table 2. 4

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1993 Wheatgrass Variety Adaptation Test
Scott, SK

| Variety | 1999 Forage Yield (Hand-Clipping versus Machine Harvesting) | | | | | | |
	Clipped Forage Yield (kgDM/ha)	Machine Harvested Forage Yield (kgDM/ha)	Clipping+Machine Forage Yield (kgDM/ha)	Predicted Forage Yield (kgDM/ha)	Clipped as % of Harvested Forage Yield %	Clipped as % of Total Forage Yield %	Clipped as % of Predicted Forage Yield %
Greenleaf intermediate	2196	1881	4076	4184	153	54	56
Clarke intermediate	2263	2001	4264	4306	118	54	53
Walsh western	3093	3121	6214	6097	117	51	52
Sodar streambank	2597	2290	4887	4882	114	53	53
Orbit tall	2018	1792	3811	3812	113	53	53
Nordan crested	3070	3045	6115	5895	104	51	53
Elbee northern	2878	3249	6127	6127	99	48	48
Fairway crested	2824	3442	6266	6328	85	45	45
Parkway crested	3287	4196	7483	7150	79	44	46
Chief intermediate	2505	4648	7153	6980	55	35	36
Summit crested	2601	5306	7907	8360	48	33	31
Mean	2677	3111	5789	5773			
CV (%)	17	26	16	14			
LSD (0.05)	ns	1393	1594	1339			

Note: The Prediction equation for the Predicted Forage Yield

	Significance Level (0.05)	Adjusted R-Squared
Crested Wheatgrass Total Yield = 2576 + 1.09 * Machine Harvested Yield	***	89%
Intermediate Wheatgrass Total Yield = 2285 + 1.01*Machine Harvested Yield	***	90%
Northern Wheatgrass Total Yield = 3395+0.841*Machine Harvested Yield	ns	73%
Tall Wheatgrass Total Yield = 353+1.93*Machine Harvested Yield	*	100%
Streambank Wheatgrass Total Yield = 1058+1.67*Machine Harvested Yield	ns	4%
Western Wheatgrass Total Yield = 4361+0.594*Machine Harvested Yield	ns	91%

Note: The above Prediction equations for the Predicted Forage Yield are based on only one year and should be used with caution.

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Table 2. 5

1993 Wildrye Variety Adaptation Test
Scott, SK

Variety	1994 Total Forage Yield (kgDM/ha)	1995 Total Forage Yield (kgDM/ha)	1996 Total Forage Yield (kgDM/ha)	1997 Total Forage Yield (kgDM/ha)	1999 Total Forage Yield (kgDM/ha)	5 year average Harvested Forage Yield (kgDM/ha)	5 year average % of Swift
Mayak russian	2522	3696	6069	2996	7370	4531	114
Tetracan russian	2191	3118	5614	2906	5638	3893	98
Cabree russian	2049	3214	6354	2389	4943	3790	95
Pearl dahu	2873	3138	5515	1916	2336	3155	79
Prairieland dahu	2835	3018	4512	2256	3097	3144	79
Eejay dahu	2927	3013	4400	1868	2432	2928	73
Mean	2534	3291	5273	2532	4535	3633	
CV. (%)	10	12	14	20	15		
LSD (0.05)	323	509	960	668	1590		

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1993 Wheatgrass Variety Adaptation Test
Scott, SK

Variety	Clipped Forage Yield (kgDM/ha)	Machine Harvested Forage Yield (kgDM/ha)	Clipping + Machine Forage Yield (kgDM/ha)	Predicted Forage Yield (kgDM/ha)	Clipped as % of Harvested Forage Yield %	Clipped as % of Total Forage Yield %	Clipped as % of Predicted Forage Yield %
			1999 Forage Yield (Hand-Clipping versus Machine Harvesting)				
Greenleaf intermediate	2195	1881	4076	4184	153	54	56
Kirk crested	2794	2369	5164	5159	133	56	55
Clarke intermediate	2263	2001	4264	4306	118	54	53
Walsh western	3093	3121	6214	6097	117	51	52
Sodar streambank	2597	2290	4887	4882	114	53	53
Orbit tall	2018	1792	3811	3812	113	53	53
Nordan crested	3070	3045	6115	5895	104	51	53
Elbee northern	2878	3249	6127	6127	99	48	48
Fairway crested	2824	3442	6266	6328	85	45	45
Parkway crested	3287	4196	7483	7150	79	44	46
Chief intermediate	2505	4648	7153	6980	55	35	36
Summit crested	2601	5306	7907	8360	48	33	31
Mean	2677	3111	5789	5773			
C.V. (%)	17	26	16	14			
LSD (0.05)	ns	1393	1594	1339			

Note: The Prediction equation for the Predicted Forage Yield

	Significance Level (0.05)	Adjusted R-Squared
Crested Wheatgrass Total Yield = 2576 + 1.09 * Machine Harvested Yield	***	89%
Intermediate Wheatgrass Total Yield = 2285 + 1.01*Machine Harvested Yield	***	90%
Northern Wheatgrass Total Yield = 3395+0.841*Machine Harvested Yield	ns	73%
Tall Wheatgrass Total Yield = 353+1.93*Machine Harvested Yield	*	100%
Streambank Wheatgrass Total Yield = 1058+1.67*Machine Harvested Yield	ns	4%
Western Wheatgrass Total Yield = 4361+0.594*Machine Harvested Yield	ns	91%

Note: The above Prediction equations for the Predicted Forage Yield are based on only one year and should be used with caution.

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Table 2. 5

1993 Wildrye Variety Adaptation Test
Scott, SK

Variety	1994 Total Forage Yield (kgDM/ha)	1995 Total Forage Yield (kgDM/ha)	1996 Total Forage Yield (kgDM/ha)	1997 Total Forage Yield (kgDM/ha)	1999 Total Forage Yield (kgDM/ha)	5 year average Harvested Forage Yield (kgDM/ha)	% of Swift
Mayak russian	2522	3696	6069	2996	7370	4531	114
Swift russian	2340	3841	4444	3390	5930	3989	100
Tetracan russian	2191	3118	5614	2906	5638	3893	98
Cabree russian	2049	3214	6354	2389	4943	3790	95
Pearl dta	2873	3138	5515	1916	2336	3155	79
Prairieland dta	2835	3018	4512	2256	3097	3144	79
Ejay dta	2927	3013	4400	1868	2432	2928	73
Mean	2534	3291	5273	2532	4535	3633	
C.V. (%)	10	12	14	20	15		
LSD (0.05)	323	509	960	668	1590		

Table 2. 6

1993 Wildrye Variety Adaptation Test
Scott, SK

Variety	1999 Forage Yield (Hand-Clipping versus Machine Harvesting)						
	Clipped Forage Yield (kgDM/ha)	Machine Harvested Forage Yield (kgDM/ha)	Clipping+Machine Forage Yield (kgDM/ha)	Predicted Forage Yield (kgDM/ha)	Clipped as % of Harvested Forage Yield %	Clipped as % of Total Forage Yield %	Clipped as % of Predicted Forage Yield %
Pearl dahi	2764	2336	5100	5069	122	54	55
Eejay dahi	2750	2432	5182	5146	113	53	53
Prairieland dahi	2581	3097	5678	5752	85	45	45
Cabree russian	2814	4943	7757	7871	61	37	37
Swift russian	3137	5930	9067	8967	53	35	35
Mayak russian	3425	7370	10795	10564	49	32	33
Tetracan russian	2723	5638	8361	8642	49	33	32
Mean	2885	4535	7420	7429			
CV. (%)	10	15	13	13			
LSD (0.05)	ns	1590	1770	1730			

Note: The Prediction equation for the Predicted Forage Yield

Russian Wildrye Grass Total Forage Yield = 2384+1.11*Machine Harvested Yield

Altai Wildrye Grass Total Forage Yield = 2928+0.912*Machine Harvested Yield

Note: The above Prediction equations for the Predicted Forage Yield are based on only one year and should be used with caution.

Significance Level (0.05)   Adjusted R-Squared

***   93%

*   58%

Table 2. 7

Combined Forage Yield of all Grasss Species at
Scott, SK
Plots were sown in 1993

Variety	1994 Total Forage Yield (kg DM/ha)	1995 Total Forage Yield (kg DM/ha)	1996 Total Forage Yield (kg DM/ha)	1997 Total Forage Yield (kg DM/ha)	1999 Total Forage Yield (kg DM/ha)	5 year average Harvested Forage Yield (kg DM/ha)	5 year average % of Carlton Smooth Brome
Paddock meadow	7762	2710	7413	5004	2855	5149	87
Carlton smooth	**8876**	**3033**	**8013**	**6331**	**3356**	**5922**	**100**
Summit crested	6560	2605	6327	4878	4648	5004	84
Fleet meadow	7308	2705	6118	3946	3489	4713	80
Signal smooth	8313	2475	7344	5673	3397	5440	92
Parkway crested	5054	2997	6479	5367	3442	4668	79
Magna smooth	8448	2453	6582	4178	4126	5158	87
Rebound smooth	6880	2640	7173	5560	3241	5099	86
Kirk crested	6206	3220	6549	4469	1792	4447	75
Mayak russian	2522	3696	6069	2996	7370	4531	77
Nordan crested	5534	2581	6266	4264	3045	4338	73
Chief intermediate	9649	3298	5279	4640	1881	4949	84
Baylor smooth	7116	2204	7017	4393	3875	4921	83
Regar meadow	6403	2208	5804	3739	2942	4219	71
Fairway crested	4946	2566	6067	4770	3121	4294	73
Greenleaf intermediat	9013	2613	5226	3722	2290	4573	77
Clarke intermediate	9153	2606	4480	4011	2369	4524	76
Swift russian	2340	3841	4444	3390	5930	3999	67
Orbit tall	5364	2089	3764	2102	3249	3313	56
Tetracan russian	2191	3118	5614	2906	5638	3893	66
Cabree russian	2049	3214	6354	2389	4943	3790	64
Sodar streambank	4046	867	4123	2320	4196	3110	53
Walsh western	3628	690	3319	1690	5306	2927	49
Elbee northern	4865	1028	4034	2430	2001	2872	48
Pearl ctci	2873	3138	5515	1916	2336	3155	53
Prairieland altai	2835	3018	4512	2256	3097	3144	53
Eejay altai	2927	3013	4400	1868	2432	2928	49

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Table 2. 6

1993 Wildrye Variety Adaptation Test
Scott, SK

Variety	1999 Forage Yield (Hand-Clipping versus Machine Harvesting)						
	Clipped Forage Yield (kgDM/ha)	Machine Harvested Forage Yield (kgDM/ha)	Clipping+Machine Forage Yield (kgDM/ha)	Predicted Forage Yield (kgDM/ha)	Clipped as % of Harvested Forage Yield %	Clipped as % of Total Forage Yield %	Clipped as % of Predicted Forage Yield %
Pearl dtd	2764	2336	5100	5059	122	54	55
Eejay dtd	2750	2432	5182	5146	113	53	53
Prairieland dtd	2581	3097	5678	5752	85	45	45
Cabree russian	2814	4943	7757	7871	61	37	37
Mayak russian	3425	7370	10795	10664	49	32	33
Tetracan russian	2723	5638	8361	8642	49	33	32
Mean	2885	4535	7420	7429			
CV (%)	10	15	13	13			
LSD (0.05)	ns	1590	1770	1730			

Note: The Prediction equation for the Predicted Forage Yield:
Russian Wildrye Grass Total Forage Yield = 2384+1.11*Machine Harvested Yield
Altd Wildrye Grass Total Forage Yield = 2928+0.912*Machine Harvested Yield
Note: The above Prediction equations for the Predicted Forage Yield are based on only one year and should be used with caution.

Significance Level (0.05)   Adjusted R-Squared
***   93%
*   58%

Table 2. 7

Combined Forage Yield of all Grasss Species at
Scott, SK
Plots were sown in 1993

Variety	1994	1995	1996	1997	1999	5 year average	
	Total Forage Yield (kg DM/ha)	Total Forage Yield (kg DM/ha)	Total Forage Yield (kg DM/ha)	Total Forage Yield (kg DM/ha)	Total Forage Yield (kg DM/ha)	Harvested Forage Yield (kg DM/ha)	% of Carlton Smooth Brome
Paddock meadow	7762	2710	7413	5004	2855	5149	87
Summit crested	6560	2605	6327	4878	4648	5004	84
Fleet meadow	7308	2705	6118	3946	3489	4713	80
Signal smooth	8313	2475	7344	5673	3397	5440	92
Parkway crested	5054	2997	6479	5367	3442	4668	79
Magna smooth	8448	2453	6582	4178	4126	5158	87
Rebound smooth	6880	2640	7173	5560	3241	5099	86
Kirk crested	6206	3220	6549	4469	1792	4447	75
Mayak russian	2522	3696	6069	2996	7370	4531	77
Nordan crested	5534	2581	6266	4264	3045	4338	73
Chief intermediate	9649	3298	5279	4640	1881	4949	84
Baylor smooth	7116	2204	7017	4393	3875	4921	83
Regar meadow	6403	2208	5804	3739	2942	4219	71
Fairway crested	4946	2566	6067	4770	3121	4294	73
Greenleaf intermediat	9013	2613	5226	3722	2290	4573	77
Clarke intermediate	9153	2606	4480	4011	2369	4524	76
Swift russian	2340	3841	4444	3390	5930	3989	67
Orbit tall	5364	2089	3764	2102	3249	3313	56
Tetracan russian	2191	3118	5614	2906	5638	3893	66
Oahree russian	2049	3214	6354	2389	4943	3790	64
Sodar streambank	4046	867	4123	2320	4196	3110	53
Walsh western	3628	690	3319	1690	5306	2927	49
Elbee northern	4865	1028	4034	2430	2001	2872	48
Peol dtcl	2873	3138	5515	1916	2336	3155	53
Prairieland altai	2835	3018	4512	2256	3097	3144	53
Eejay altai	2927	3013	4400	1868	2432	2928	49

Table 2.8

Scott Weather Data from 1991 to 1999

Mean Monthly Temperature °C

	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
1991	-15.1	-5	-5.2	5.60	10.90	15.40	17.40	20	10.70	-0.6	-8.2	-11.3
1992	-9.2	-9.4	-0.5	4.40	9.80	14.60	15.50	14.40	8.90	M	-3.8	-18.9
1993	-18.2	14.7	-3.5	4.10	11.20	13.20	14	14.90	9.30	3.40	-8.5	-9.9
1994	-19.4	-21.6	-4.7	4.20	10.90	15	17.10	16	13.40	4.30	-6.2	-13.8
1995	-14.3	-11.3	-6.4	1.10	10.40	16.50	16.80	14.80	11.50	3.50	-10.3	-16.9
1996	-23.5	-13.4	-11.1	3.20	7.70	15.20	17.20	17.30	9.40	1.90	-12.6	-18.3
1997	-20.3	-10.9	-8.4	1.80	9.70	16.50	17.80	17.80	13.30	3.30	NA	NA
1999	-17	-10	-4	5	9	13.5	15	16.8	9.5	4.4	-1.1	NA

Total Precipitation (mm)

	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Total
1991	12.40	15.80	9.70	22.20	33	111.10	18.90	41.30	6	48.80	6.90	10.60	336.70
1992	23.70	16.20	4.60	17	31.90	10.90	164.40	31.20	51.70	M	30	23.40	405
1993	3.90	2.50	17.40	44.50	21.60	100.60	82.50	38.60	24.90	10.50	20.80	9.70	377.50
1994	37.30	21.80	0.40	3.60	54.20	55.10	60.20	72.50	3.80	28	7.60	9.50	354
1995	8.50	6.40	19.30	12.90	29.90	37.50	38.90	89	5.5	15.90	29.10	17	309.90
1996	12.80	4.80	3.40	18.40	43.60	63.80	116.40	37.10	49.30	13.80	31.30	20.50	415.20
1997	8.20	53	9.80	15.20	23	68.20	26.20	29.80	50.60	16.60	NA	NA	249.10
1999	52	0.8	10.6	52	66.4	42.8	81	47.6	5.8	2	5.4	NA	366.4

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Table 2. 8

Scott Weather Data from 1991 to 1999

Mean Monthly Temperature °C

	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
Norm	-17.9	-13.7	-8.1	3	10.20	14	17.10	16	10	3.70	-6.2	-14.3
1991	-15.1	-5	-5.2	5.60	10.90	15.40	17.40	20	10.70	-0.6	-8.2	-11.3
1992	-9.2	-9.4	-0.5	4.40	9.80	14.60	15.50	14.40	8.90	M	-3.8	-18.9
1993	-18.2	14.7	-3.5	4.10	11.20	13.20	14	14.90	9.30	3.40	-8.5	-9.9
1994	-19.4	-21.6	-4.7	4.20	10.90	15	17.10	16	13.40	4.30	-6.2	-13.8
1995	-14.3	-11.3	-6.4	1.10	10.40	16.50	16.80	14.80	11.50	3.50	-10.3	-16.9
1996	-23.5	-13.4	-11.1	3.20	7.70	15.20	17.20	17.30	9.40	1.90	-12.6	-18.3
1997	-20.3	-10.9	-8.4	1.80	9.70	16.50	17.80	17.80	13.30	3.30	NA	NA
1999	-17	-10	-4	5	9	13.5	15	16.8	9.5	4.4	-1.1	NA

Total Precipitation (mm)

	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Total
Norm	16.30	12.70	16.30	22.50	36.30	61.30	61.70	46.20	30.30	16.80	15.60	17.80	353.80
1991	12.40	15.80	9.70	22.20	33	111.10	18.90	41.30	6	48.80	6.90	10.60	336.70
1992	23.70	16.20	4.60	17	31.90	10.90	164.40	31.20	51.70	M	30	23.40	405
1993	3.90	2.50	17.40	44.50	21.60	100.60	82.50	38.60	24.90	10.50	20.80	9.70	377.50
1994	37.30	21.80	0.40	3.60	54.20	55.10	60.20	72.50	3.80	28	7.60	9.50	354
1995	8.50	6.40	19.30	12.90	29.90	37.50	38.90	89	5.5	15.90	29.10	17	309.90
1996	12.80	4.80	3.40	18.40	43.60	63.80	116.40	37.10	49.30	13.80	31.30	20.50	415.20
1997	8.20	53	9.80	15.20	23	68.20	26.20	29.80	50.60	16.80	NA	NA	249.10
1999	52	0.8	10.6	52	66.4	42.8	81	47.6	5.8	2	5.4	NA	366.4

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